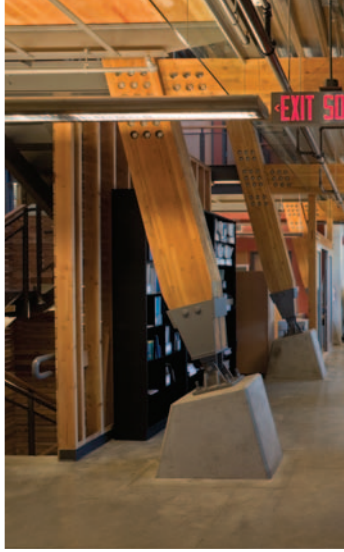

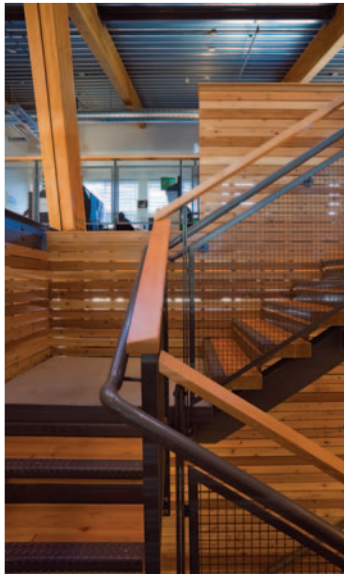

Operations Centre

GULF ISLANDS NATIONAL PARK RESERVE

Canadian Wood Council
Conseil canadien du bois

woodWORKS!
engineered for strength and style…*naturally!*

Derek Lepper

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Front cover photos by Derek Lepper

Operations Centre

Gulf Islands National Park Reserve

Introduction

Canada's newest nationally-protected area, Parks Canada's Gulf Islands National Park Reserve, includes 15 islands and inter-tidal areas flanked by the large urban centres of Victoria and Vancouver, British Columbia. After the formation of the National Park Reserve in 2003, a site was acquired in Sidney (20 kilometres (12 miles) north of Victoria) for its Operations Centre.

Completed in September 2005, the new Operations Centre provides an administrative and operations hub for the National Park Reserve, and became Canada's first LEED® Platinum certified building. The LEED Green Building Rating System™ is an industry-recognized, voluntary standard that rates buildings based on their environmental performance. To obtain the Platinum level, a building needs to obtain at least 52 points of a maximum possible 70 points. Several innovations were employed to allow the Operations Centre to obtain LEED® Platinum. For example, all of the building's space and domestic hot water heating needs are extracted from ocean water. Other features include rainwater storage for use in the building's low-flow toilets, roof-mounted solar panels supplying 20 percent of the building's energy needs, use of natural light and ventilation, landscape plantings that do not require irrigation, energy efficient lighting fixtures, and exterior sunshades to keep the building from overheating. Energy consumption for the building is 75 percent less than that of the Model National Energy Code reference building.

This LEED® Platinum building relies on glulam beams and columns for the main structural support. In addition to its ease of installation and local availability, the glulam provides interior ambience for the exposed structure. Wood-frame walls are used for a large proportion of the exterior walls and western red cedar is used extensively for both interior and exterior finishes.

With the attainment of LEED® Platinum hanging on every point, the use of wood helped obtain the necessary edge. Points were obtained for the use of wood materials from local sources and the use of formaldehyde-free millwork to advance indoor air quality. And, although not eligible for LEED® points, wood products are the only major structural and finish products that originate from renewable resources.

Building Description

Befitting its purpose, the three-storey Operations Centre is situated on waterfront property (**Figure 1**) to house the park operations and administration activities. The basement level daylights to the waterfront and is primarily used for field operations. The main floor (**Figure 2**) and second floor accommodate administration and resource management personnel in a mix of offices and open plan areas. The main floor level also features a small interpretive area in the front lobby and a large boardroom for public functions and meetings.

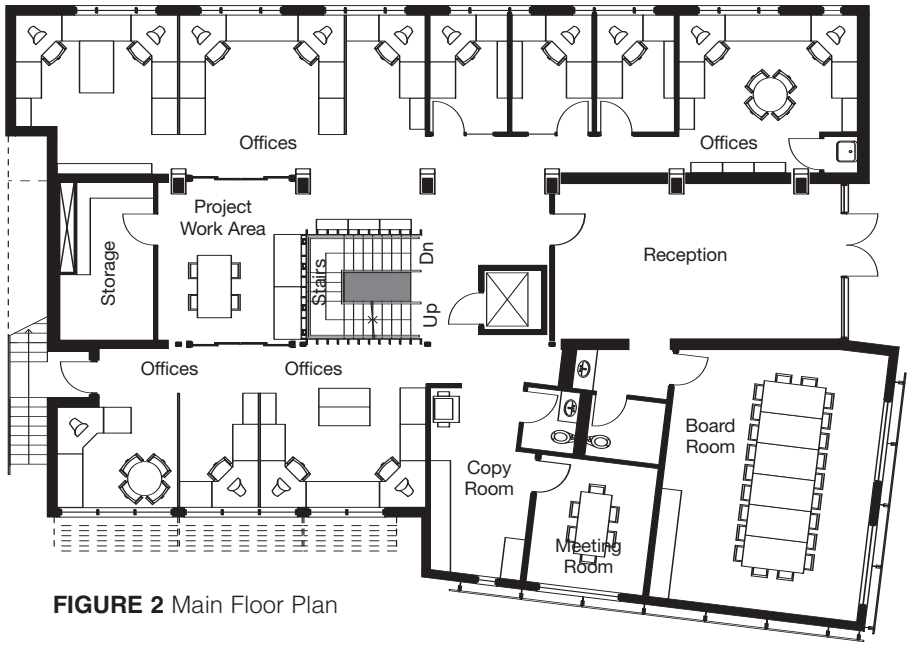

FIGURE 2 Main Floor Plan

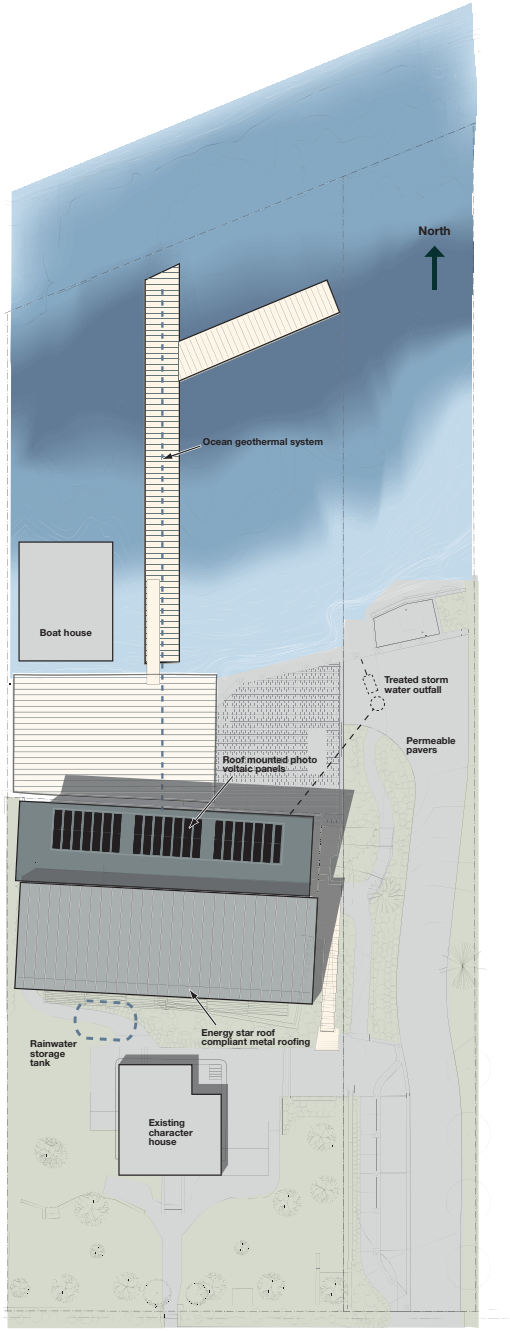

FIGURE 1 Site Plan

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The client planning group wanted to develop a building that could allow staff integration and an environment conducive to "team building" between the departments. This functional concept was developed into a building plan, centred on an atrium, meant to encourage interaction through the openness of the building. The atrium is lit by north-facing clerestory windows highlighting the exposed inclined glulam structure and visually connecting the open floor areas (**Figure 3**). Interior finishes are minimized by allowing exposed structural materials to be the finishes where possible.

The building form features a sawtooth roof meant to symbolize the rock ledges that characterize much of the shoreline found in the Gulf Islands. Each facade has been designed to respond to its orientation, with sunshades provided on the south and east facades for passive shading (**Figure 4**), and strip glazing on the north to take advantage of the expansive views over the water towards the islands.

Structure

Located on Vancouver Island, the building had to meet some of the most stringent seismic design requirements in Canada. The building is hybrid construction, and made use of concrete, steel, and wood where each worked best.

The building is founded on concrete-filled end-bearing steel pipe piles averaging 7.5 m (25 ft.) in length that were driven to refusal into bedrock. The basement is reinforced concrete and the walls serve as retaining walls on three sides, with one side day-lighting toward the ocean.

Lateral resistance for seismic forces is provided by nominally ductile reinforced concrete shearwalls that extend from the basement to the roofline. Except for the concrete shearwalls, the exterior walls are a combination of steel columns and wood-framed walls.

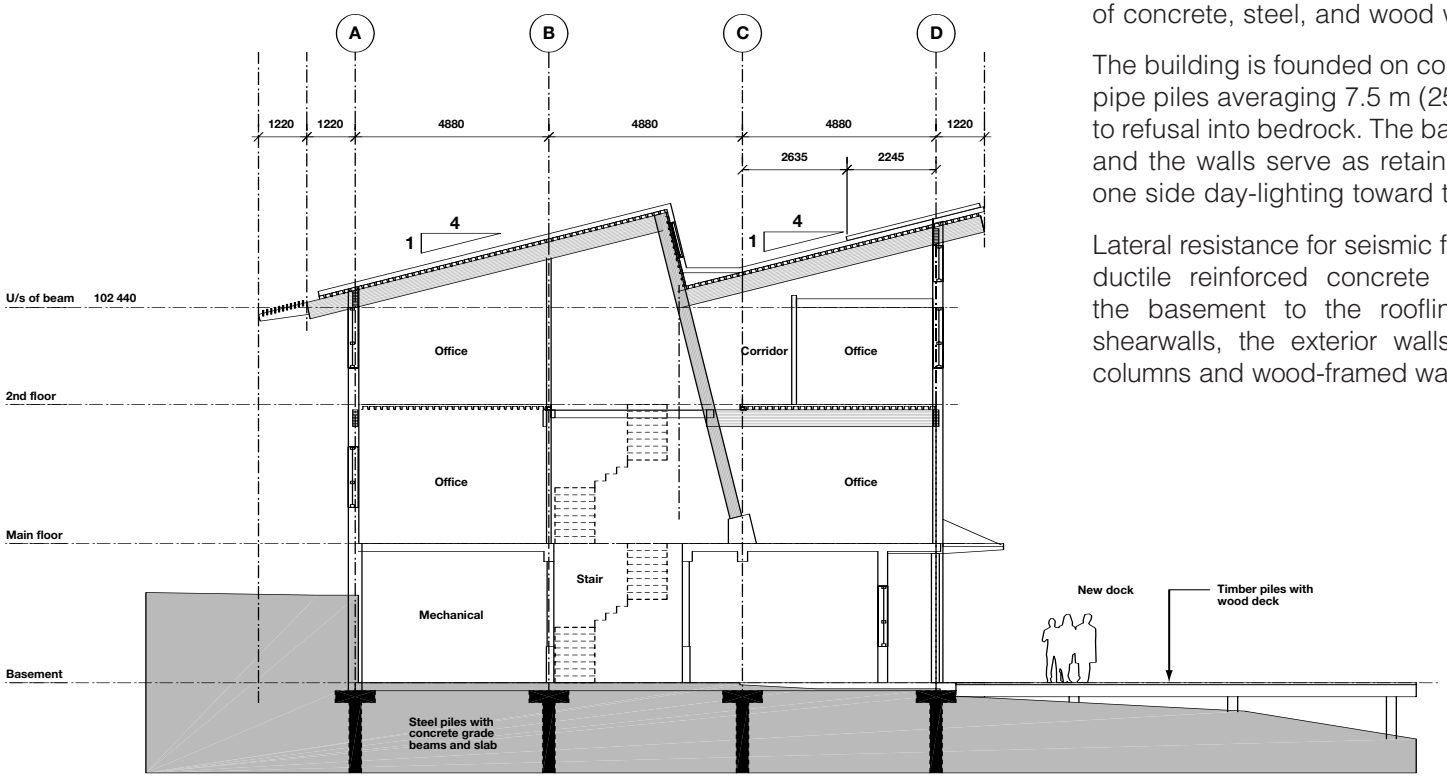

FIGURE 3 Building Cross-Section

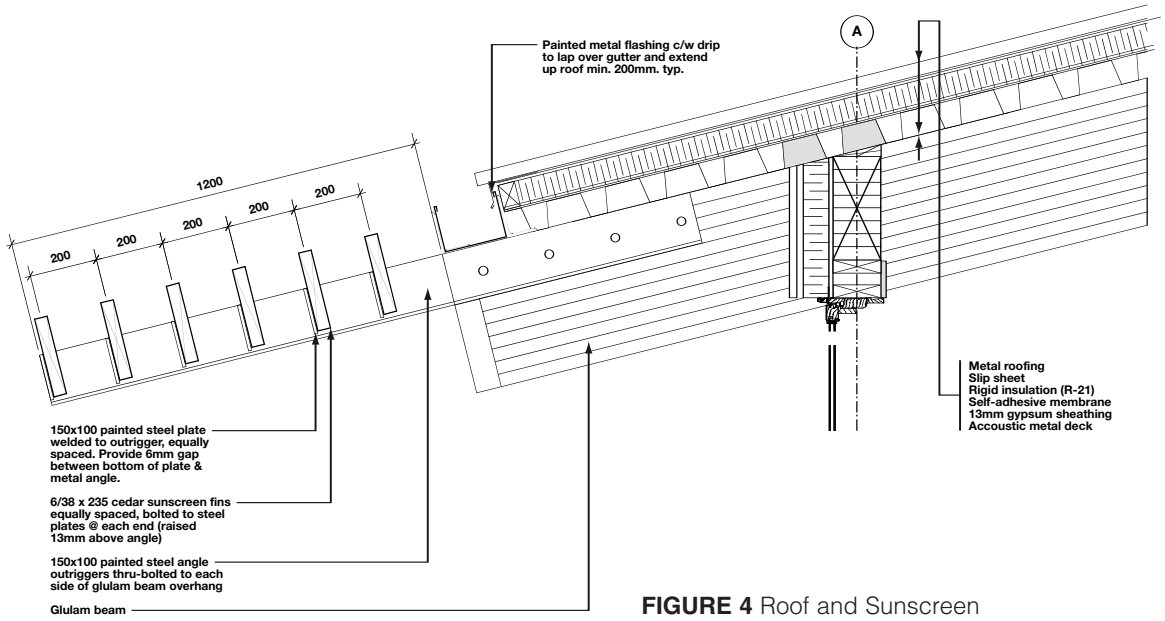

FIGURE 4 Roof and Sunscreen

The main floor is a conventionally reinforced concrete slab-and-beam construction. The second floor is a concrete-topped composite metal deck system that spans between primary glulam or steel beams.

Hollow steel columns extend from the main floor to support the glulam roof beams. The main structural members are exposed on the interior and glulam was used to provide a pleasing appearance. Interior sloped columns were provided as glulam members to further enhance the interior appearance and express the structural framework of the building. The dimensional lumber used throughout the project came from local manufacturers.

Finishes

In keeping with the sustainable objectives of the project, interior finishes were kept to a minimum by designing the exposed structural materials to be the finishes, where possible. For example, concrete floors were left exposed, except within workstations and offices, and exposed steel deck and concrete slab ceilings predominate.

The exception to this was the wood finishes, which were used generously for both the interior and exterior. As Project Architect Ron Kato of Larry McFarland Architects Ltd. exhorts “there is an abundance of natural light in the building’s interior and the use of wood contributes to the warmth and ambiance that we wanted to achieve”. An emphasis

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was placed on the selection of indigenous species for finishes and for structural applications, including western red cedar, which has a strong historic and cultural importance in coastal British Columbia. Cedar slat walls, comprised of 1 x 4 boards, were used to define the enclosure around the central stair, and to add emphasis to walls in other rooms.

Edge-grain Douglas fir was used for window and door-frames, casings and trim, and for the structural decking in the walkway bridges on the second floor. The glulam beams and columns and stair treads are also Douglas fir. All exposed wood finishes and structural members were finished with clear, water-based finishes selected on the basis of their appearance, performance characteristics and low volatile organic compound (VOC) content.

For millwork and wood doors, clear birch veneer was used over formaldehyde-free substrates. This attention to minimizing VOC emissions from all engineered wood products employed in the project, including MDF (medium density fibreboard), plywood, glulam and solid core doors, gained a valuable point in the pursuit of the LEED® Platinum rating.

On the exterior, western red cedar was used extensively as a cladding material and for the sunscreens. The cedar was finished with a breathable, water-based, clear finish that acts as a water-repellent shield and provides protection against ultra-violet (UV) degradation.

The sourcing of wood products from local manufacturers also contributed to the LEED® rating, gaining two points in the Regional Materials credit category.

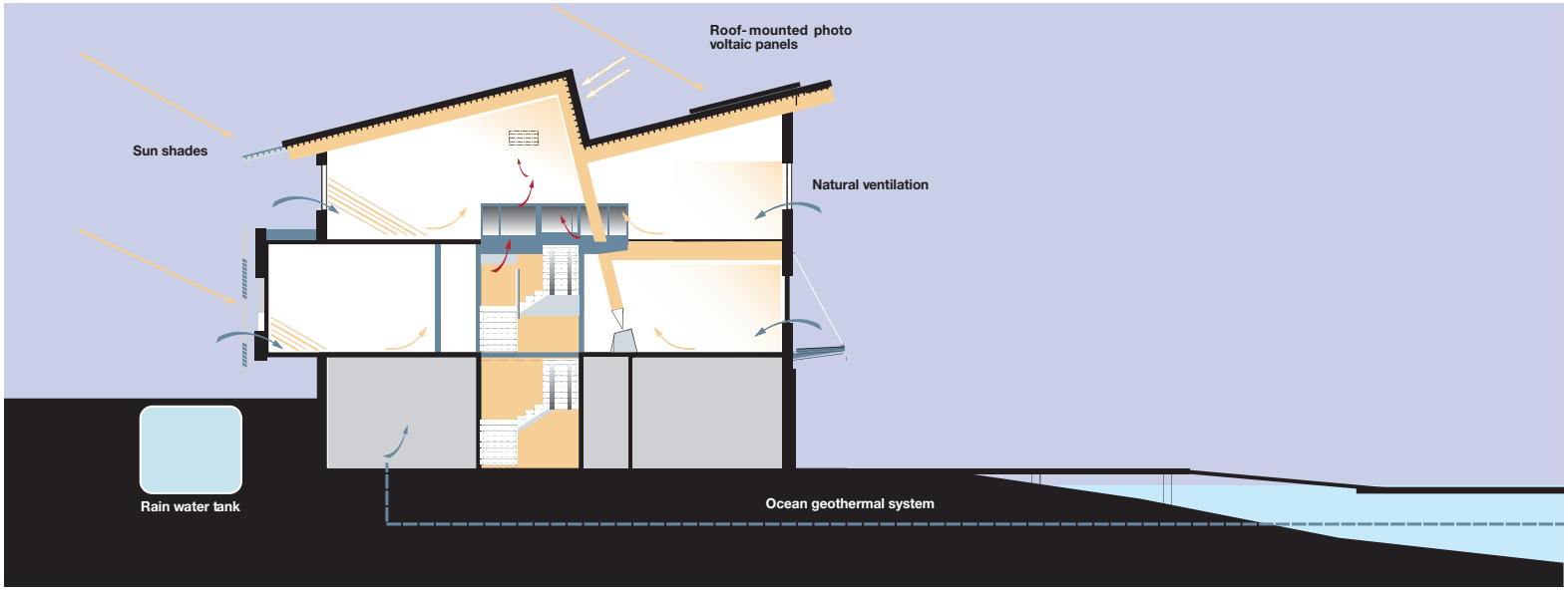

FIGURE 5 Ventilation and Natural Lighting

Fire Safety

The building is owned by Parks Canada, a federal government organization, and therefore it was designed to the National Building Code of Canada (1995). The 3-storey office building contains storage rooms, service rooms, a lab, a locker room and a wet room on the first storey (Basement Floor level), offices and meeting rooms on the second storey (First Floor level) and offices on the third storey (Second Floor level). Due to the presence of the atrium opening between the second and third stories, special fire safety features were required. For example, even though the building area and height would normally have allowed it be constructed in accordance with Part 9 (Housing and Small Buildings) of the NBCC, the rules regarding fire protection for atriums resulted in the design having to be based on Part 3 (Fire Protection, Occupant Safety and Accessibility) provisions.

The main fire safety design factors and features are as follows:

- The building is of mixed construction, with wood frame, heavy timber, concrete and steel elements used throughout.
- The building is sprinklered because of the presence of the atrium.
- The building has a footprint area of approximately 385 m^2 (4,140 $ft.^2$)
- Major Occupancy: Group D (Business and Personal Service). (The Service Rooms and Labs and Storage Rooms (Group F, Division 3) are considered subsidiary occupancies to the Group D major occupancy.).
- A fire alarm system provides electrical supervision of all fire alarm devices and provides off-site monitoring for trouble and alarm conditions.
- The building faces one street and is provided with:
  a) a fire alarm system annunciator panel
  b) a fire department (siamese) connection for the sprinkler systems
  c) a key lock box for access to the building

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The construction/structural fire protection and the fire separation requirements are as follows:

- The third storey floor assembly was constructed as a fire separation, but was not required to provide a fire resistance rating because it is of noncombustible construction.
- Based on the provision of an electrically supervised and monitored sprinkler system, the roof assembly was not required to have a fire-resistance rating.
- A central access stair serves all three levels and is separated from the lowest floor level by a 3/4-hour fire separation in order to limit the interconnected floor space to the upper two storeys.

A 30-minute emergency power supply was provided for the emergency lighting, exit lights and fire alarm system.

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Securing LEED® Platinum Rating

Parks Canada, whose mandate includes the preservation of Canada's national heritage sites, wished to make the Operation Centre a living example of that mission. Therefore, the overriding design objective for the Operations Centre was to demonstrate how a building, in the isolated island ecology of the Gulf Islands National Park Reserve, could best respond to its site and environment. It was intended to minimize the building's dependence on outside sources of energy and lessen its impact on the environment. Natural resources available to the site (such as the ocean, sunlight and the abundant rainfall) were to be considered in the design.

The following sections summarize the measures taken to obtain the LEED® Platinum level accreditation.

Sustainable Sites

Erosion and Sedimentation Control
Strict erosion and sedimentation control measures were followed throughout the construction process.

Alternative Transportation
The facility is located near public transit. Bicycle racks and showers were provided for staff use. Parks Canada supports alternative fuel technologies and acquired a fleet vehicle for the Operations Centre to reduce fossil fuel consumption.

Preservation of Open Space
The new facility is located on the waterfront at the rear of the property. The original house (former temporary office) on the property has been preserved and will continue to be used. The lawn and ornamental gardens were retained to maintain the neighbourhood character.

Storm Water Storage and Treatment
Rainwater is collected from the roof and stored. It is used for flushing toilets and washing equipment in the marina. Surplus stormwater flows through a sediment trap and oil separator before being discharged into the ocean.

Contaminated Site Remediation
A minor amount of contaminated material was discovered on the site. This material was removed in accordance with Federal standards and procedures.

Exterior Lighting
The exterior lighting was designed to limit the amount of light crossing property lines.

Water Efficiency

New Planting
New planting is drought-resistant and will not require irrigation once established.

Use of Rainwater
Rainwater collected from the roofs is directed to a 30,000 litre (6,600 gal.) underground storage tank. This water is then used for flushing toilets and as equipment wash water in the marina. It is expected that over 108,000 litres (23,760 gal.) of water will be collected and used annually.

Sanitary Waste
By using rainwater to flush toilets, the volume of municipally treated potable water used for the conveyance of sanitary waste was reduced by 99%.

Potable Water
The volume of municipally treated potable water used within the new facility was reduced by over 60%.

Energy & Atmosphere

One of the primary design goals was to minimize energy consumption in the new facility.

Energy Performance
Energy consumption was reduced by approximately 75% in comparison to the Model National Energy Code reference building. A computer simulation of the building systems' energy use was used to design heating, cooling, ventilation and lighting systems.

Ocean-based Geothermal System
An ocean-based geothermal heat pump system was built to provide all the heat and domestic hot water needs for the building. Ocean water is pumped into the building and passes through a heat exchanger. Heat pumps are then used to extract the available heat energy.

Radiant Heating and Cooling System
A system of plastic pipes was embedded in the concrete floors to distribute heat and moderate the temperature throughout the building. This radiant heating and cooling system greatly reduces energy consumption.

Commissioning
The building benefited from the services of a Commissioning Agent who fine-tuned the buildings' complex mechanical systems to maximize performance.

Lighting
Energy-efficient fluorescent lamps were used. Lights adjacent to windows were furnished with photo-sensors to adjust artificial lighting levels automatically to correspond with daylight levels. Occupancy sensors turn off lights when occupants are not present. The placement of lighting fixtures was coordinated with the furniture and office layout to minimize the number of fixtures required.

Exterior Sunshades
Exterior sunshades were installed over south facing windows to limit the amount of direct sunlight penetrating the windows.

Thermal Bridging
The building envelope and cladding system were designed to minimize heat loss.

Photo Voltaic Panels
A photovoltaic system was installed that is capable of providing 20% of the building's energy requirements.

Materials & Resources

Construction Waste Management
The contractor implemented a waste management plan to minimize waste from construction materials. Approximately 85% of construction waste was diverted from landfill, including wood waste.

Local and Regional Materials
More than 20% of the building materials came from local and regional manufacturing including:

- Concrete floors and walls
- Glulam columns and beams
- Wood framing for walls and partitions
- Western red cedar siding
- Douglas fir decking

Recycled Content of Building Materials

More than 27% (based on cost) of the building materials were manufactured from recycled materials including:

- Fly ash (to replace some of the cement in the concrete)
- Steel
- Thermal insulation
- Millwork panel products
- Carpet tile
- Aluminum frames
- Gypsum wallboard

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Indoor Environmental Quality

Carbon Dioxide Sensors
Carbon dioxide sensors were linked to the ventilation system. If a predetermined level of CO_2 is detected in a room, the building control system admits fresh air.

Operable Windows and Daylight
The building was planned so that all workstations and offices would have operable windows and an abundance of natural light.

Natural Ventilation
The open plan and atrium design of the building encourages natural ventilation (**Figure 5**, page 6) . Motorized louvers were located at the roof level and at each floor, and are controlled by the building control system.

Emissions from Materials and Finishes
Finishes and materials used inside the building were selected based on low emissions, durability and cost including:

- Adhesives and sealants
- Paints and coatings
- Carpet
- Composite wood and laminate adhesives

Indoor Air Quality

During Construction
An Indoor Air Quality Management plan was developed at the beginning of construction to give guidelines to the contractor on acceptable construction procedures. This included ensuring all HVAC components were kept clean and materials were protected from the weather.

Post Construction
The building was ventilated prior to occupancy to help remove contaminants in the air.

Controllability of Systems
All occupied rooms were equipped with multiple controls to allow occupants to have a high degree of control over their lighting levels and temperature.

Innovation in Design
The project obtained additional credits for the following:

- Selection of workstations: Parks Canada purchased workstations selected on the basis of materials and manufacturing processes.
- Energy performance: The building significantly exceeds the highest LEED® level for energy performance.
- Green housekeeping: The facility management policy stipulates the use of non-hazardous products.

Although not applicable for LEED® credit, the exterior wall assembly was engineered to minimize heat losses (**Figure 6**) and to withstand the salt-air environment.

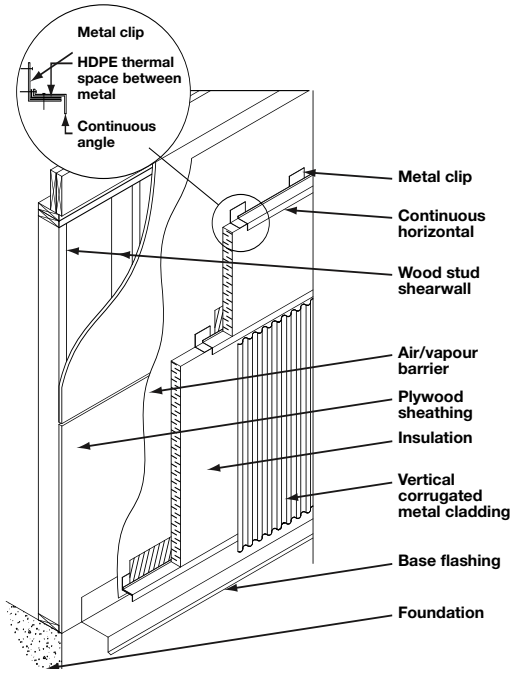

FIGURE 6 Typical Exterior Wall

Conclusion

The LEED Green Building Rating System™ is a comprehensive rating system that takes into account the environmental impacts of site and materials selection, demolition, and construction. As the only LEED® Platinum building in Canada to date, there is much to be learned from the Gulf Islands Operations Centre.

Many proven technologies and products were incorporated, that, in combination, resulted in a building that significantly reduces reliance on fossil fuels and municipal water and wastewater services. Wood is the dominant architectural finish both inside and outside the building. And the use of wood, the only major renewable construction material, helped secure the last precious points needed to obtain the LEED® Platinum rating for this signature building.

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